DASH and Similar Dietary Approaches to Hypertension and Reduced Risk Diabetes and Cardiovascular Disease

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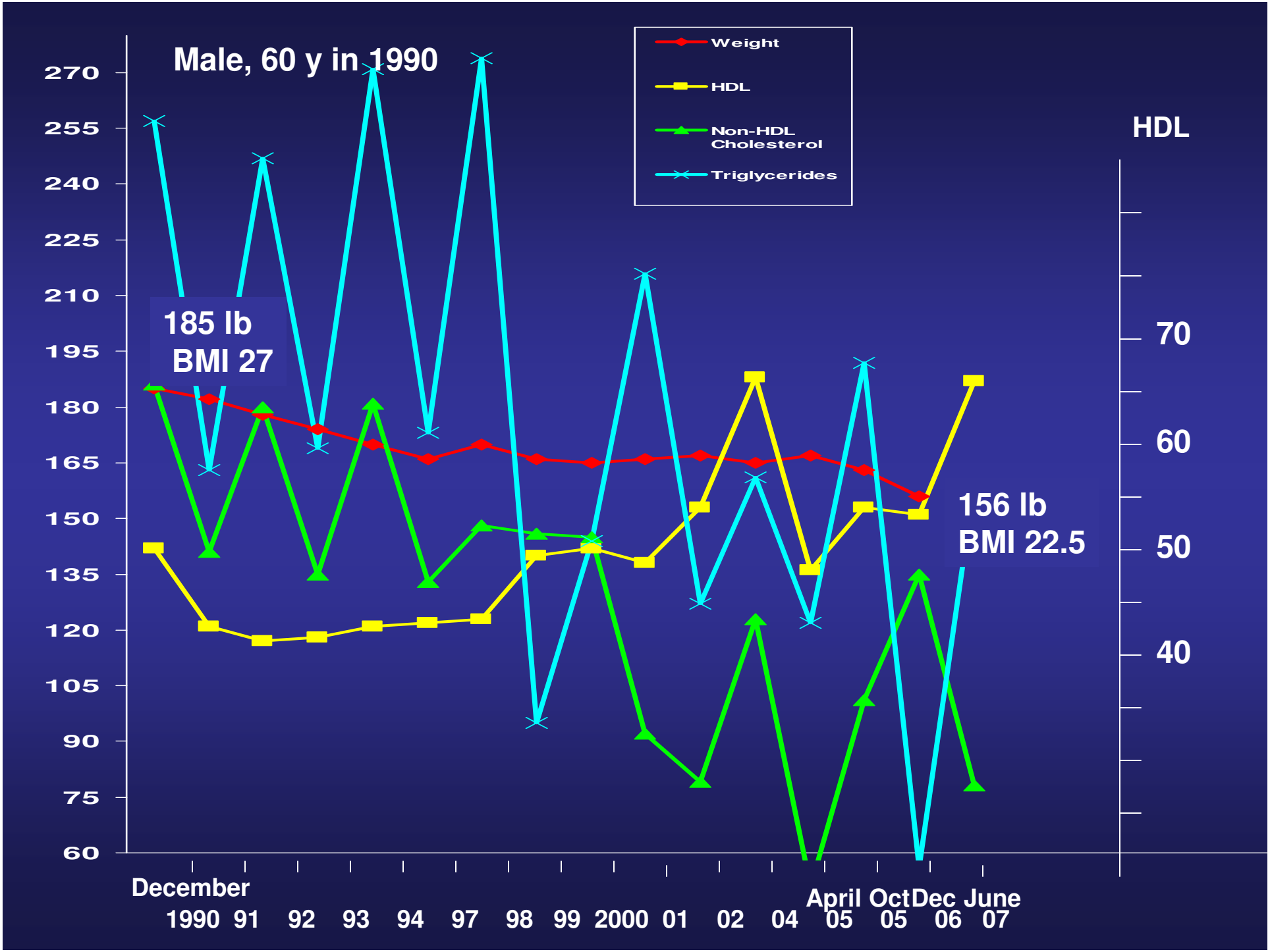
Case of Sudden Cardiac Death

- Famous middle-aged man died suddenly of heart attack. No previous symptoms of heart disease. Autopsy showed ruptured cholesterol plaque in the major coronary artery.
- Type 2 diabetes: several years duration, treated adequately
- Hypertension: well-controlled with medicines
- Non-smoker
- Aspirin 81 mg
- Low LDL-cholesterol: 68 mg/dL taking a statin
- High triglycerides
- Low HDL-cholesterol: 37 mg/dL
- Obesity, BMI 31
- Nutrition: Frequently sighted at steak houses
- Exercise: Workouts several times per week, passed exercise stress test


Male, 60 y in 1990
Weight
HDL
Non-HDL Cholesterol
Triglycerides
HDL
185 lb
BMI 27
156 lb
BMI 22.5
270
255
240
225
210
195
180
165
150
135
120
105
90
75
60
70
60
50
40
December
1990
91
92
93
94
97
98
99
2000
01
02
04
April
05
Oct
05
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06
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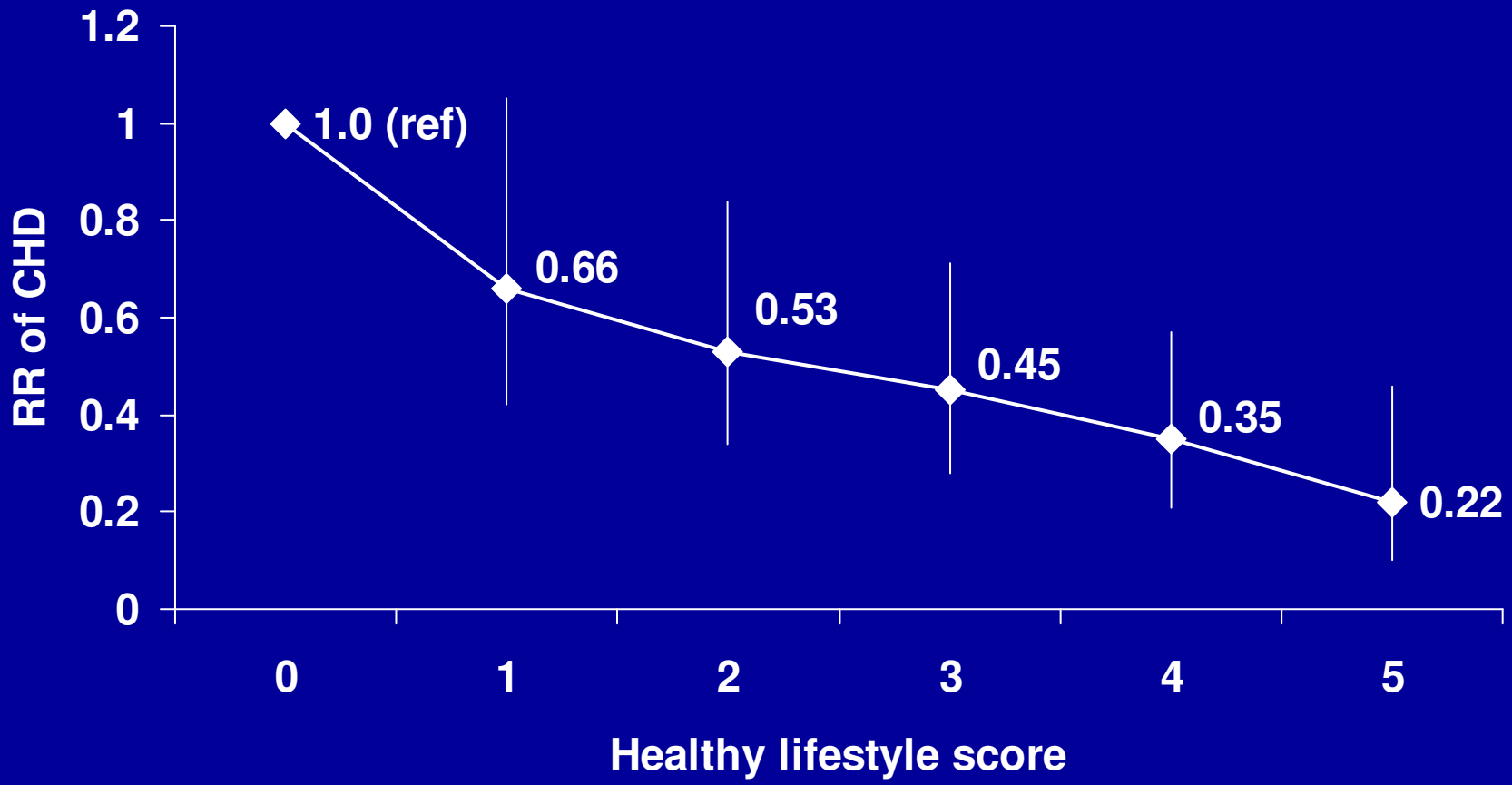
07

Big Cholesterol Response to Dietary Change

- 52 year old man, good health
- High TG, Low HDL since age 30
- In 1985 - 2001: High TG 300-400; Low HDL 20-25; Average LDL 124
- Body Mass Index
  - age 20 = 18 kg/M2
  - age 52 = 24.5; 58 lb gain; now has a “paunch”
- Family History: 2 maternal uncles had high TG and CHD in their 60’s
- Mediterranean, Willett-book diet, 2 glasses wine
- Walks 3 miles per day
- July, 2008: TG 189, HDL 34, apoB 116 (high); CRP 1.8
- Lost 9 pounds, BMI = 23, smaller paunch
- Nov, 2008: TG 88, HDL 38, apoB 86, CRP 1.4

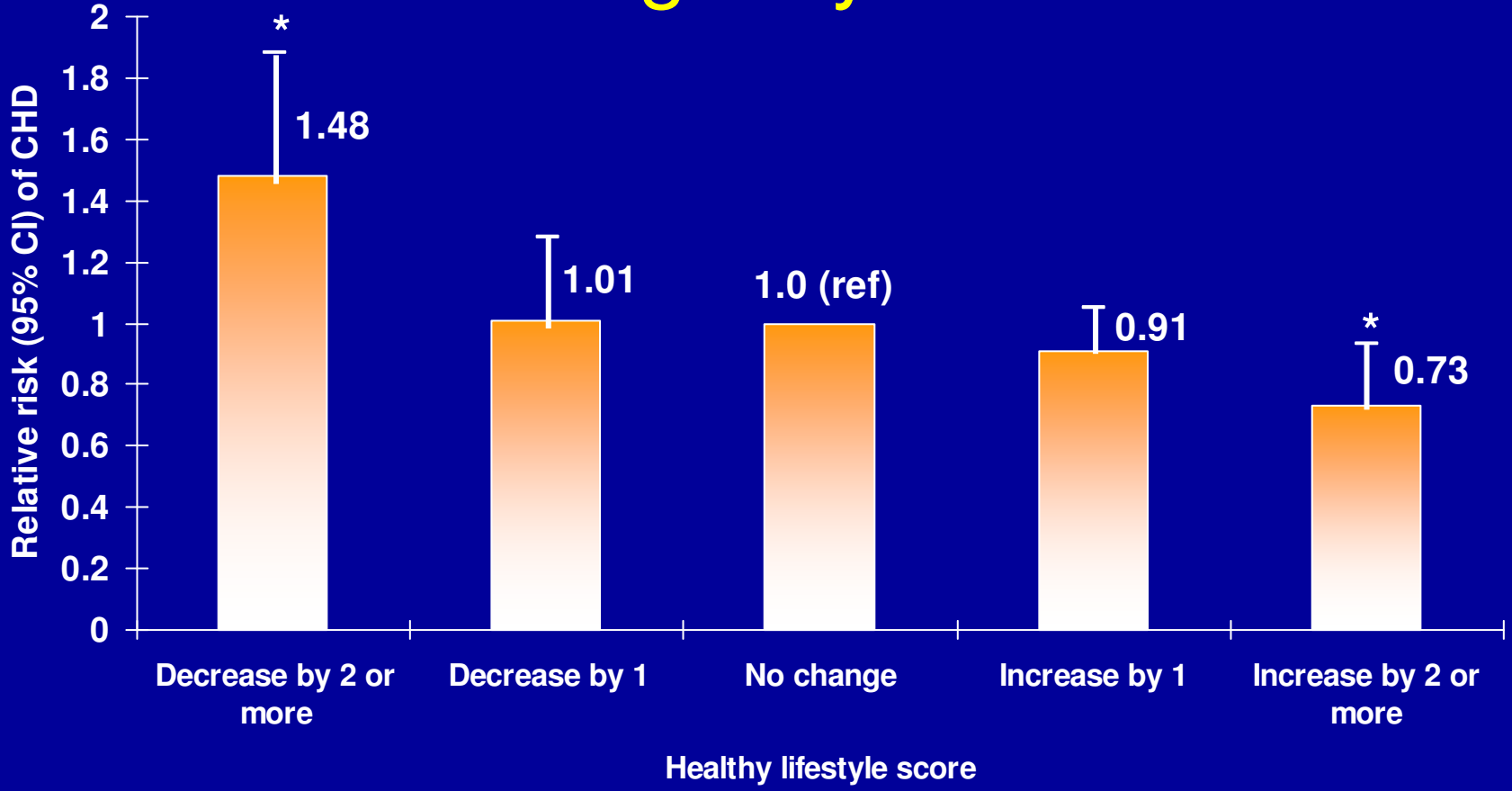
Healthy lifestyle score* and Heart disease among men taking cholesterol or blood pressure medications

* Healthy diet, not overweight, moderate alcohol drinking, no smoking, regular exercise



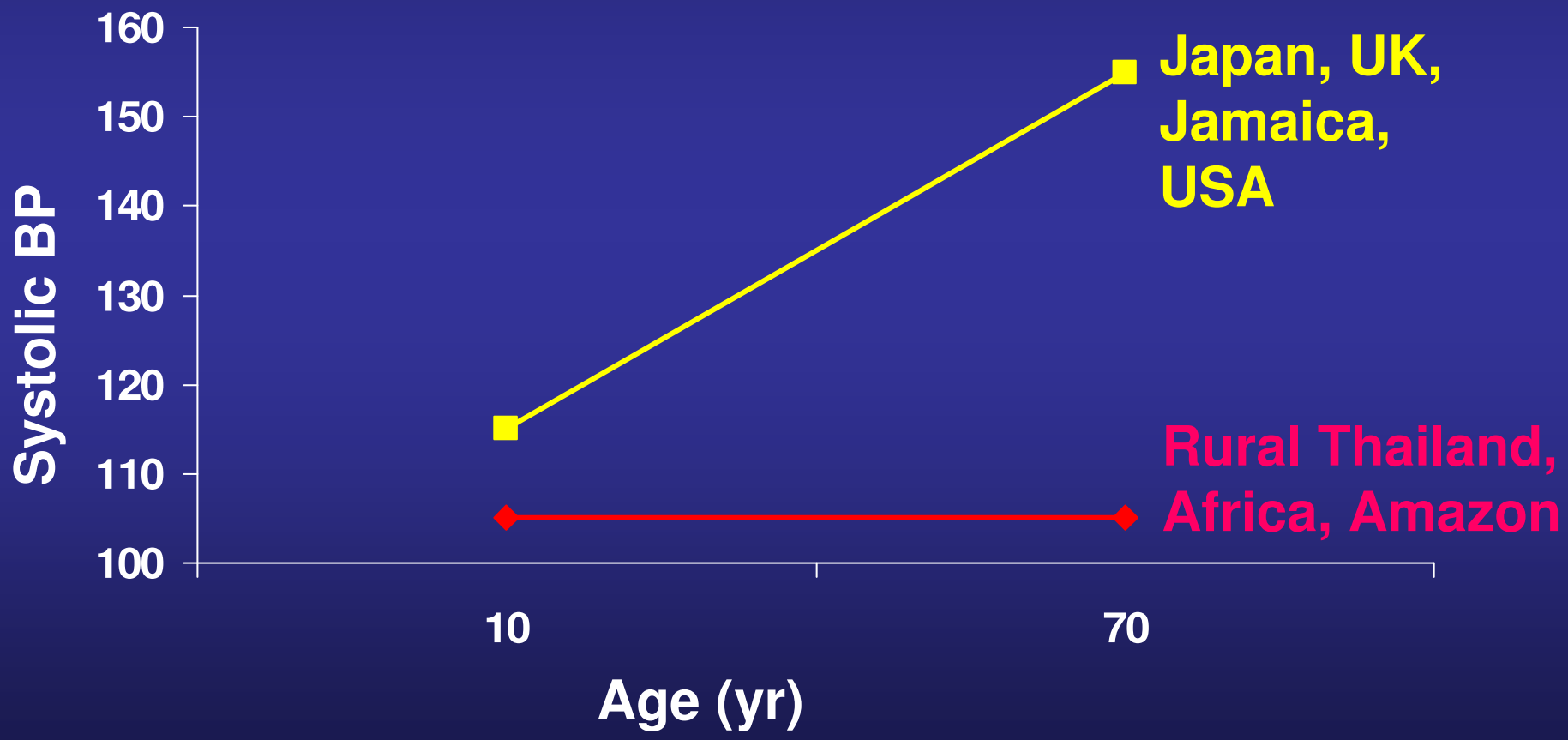
Chiuve, Circulation 2006

Risk of CHD in men according to changes in healthy lifestyle score during 14 years



Chiuve, Circulation 2006

Blood Pressure Patterns Worldwide



Epstein FH. Epidemiology of Hypertension, 1967

Characteristics of Populations with Low Blood Pressure

- Very low salt intake (10-50 mmol/d)
- Vegetable products are staples
- Low meat intake
- Low prevalence of overweight

The DASH Dietary Pattern: **Foods**

Emphasizes:

Fruits, Vegetables, Low-fat Dairy Foods

Includes:

Whole Grains, Nuts, Poultry, Fish

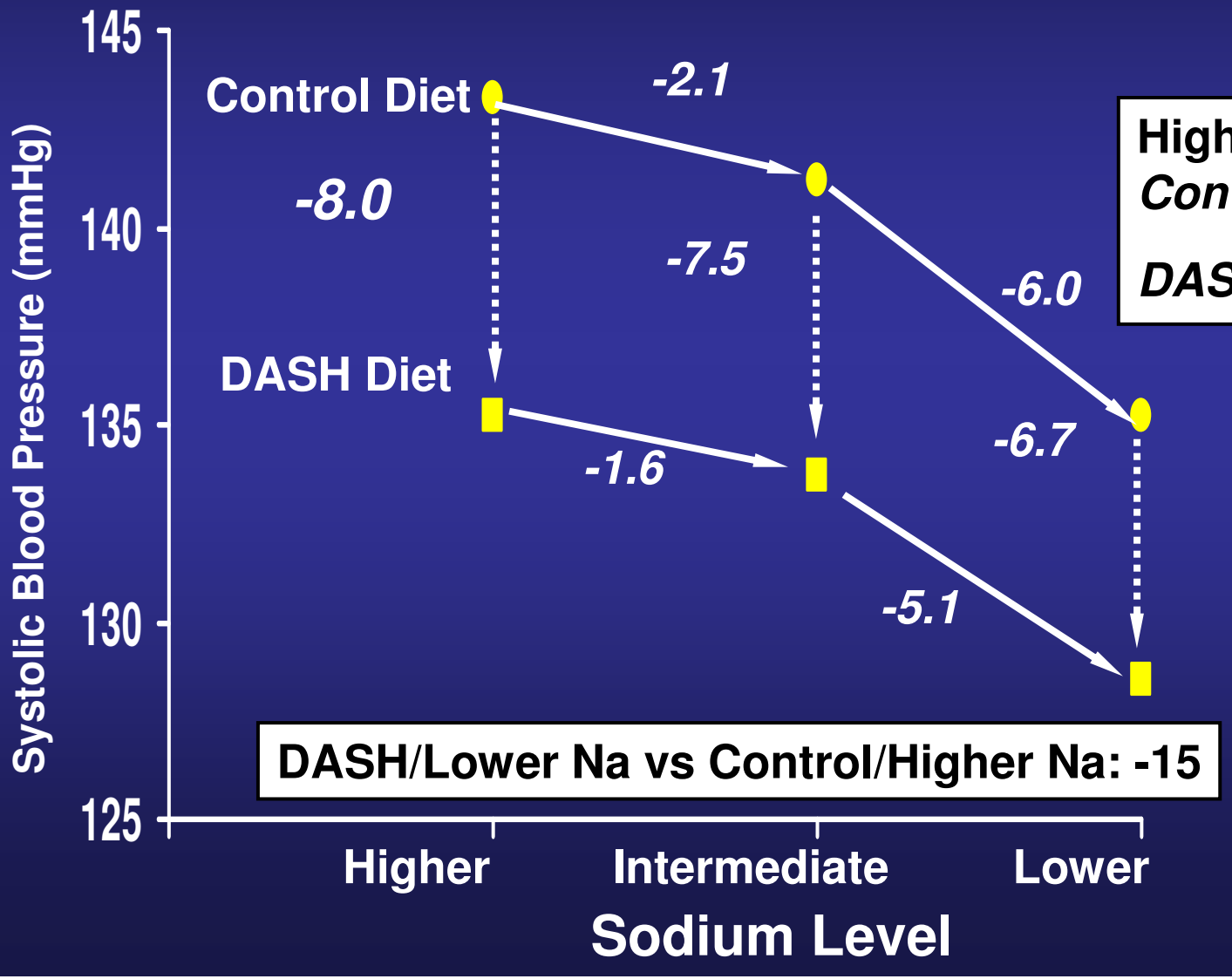
Reduced in:

Fats (27%), Red Meat, Sweets, and Sugar-containing Beverages.

DASH-Sodium: Low sodium,1.5 g

Age > 45 and Hypertensive

(Bray G. Am J Cardiol July 15 2004)



Higher to Lower Na

Control: - 8

DASH: - 7

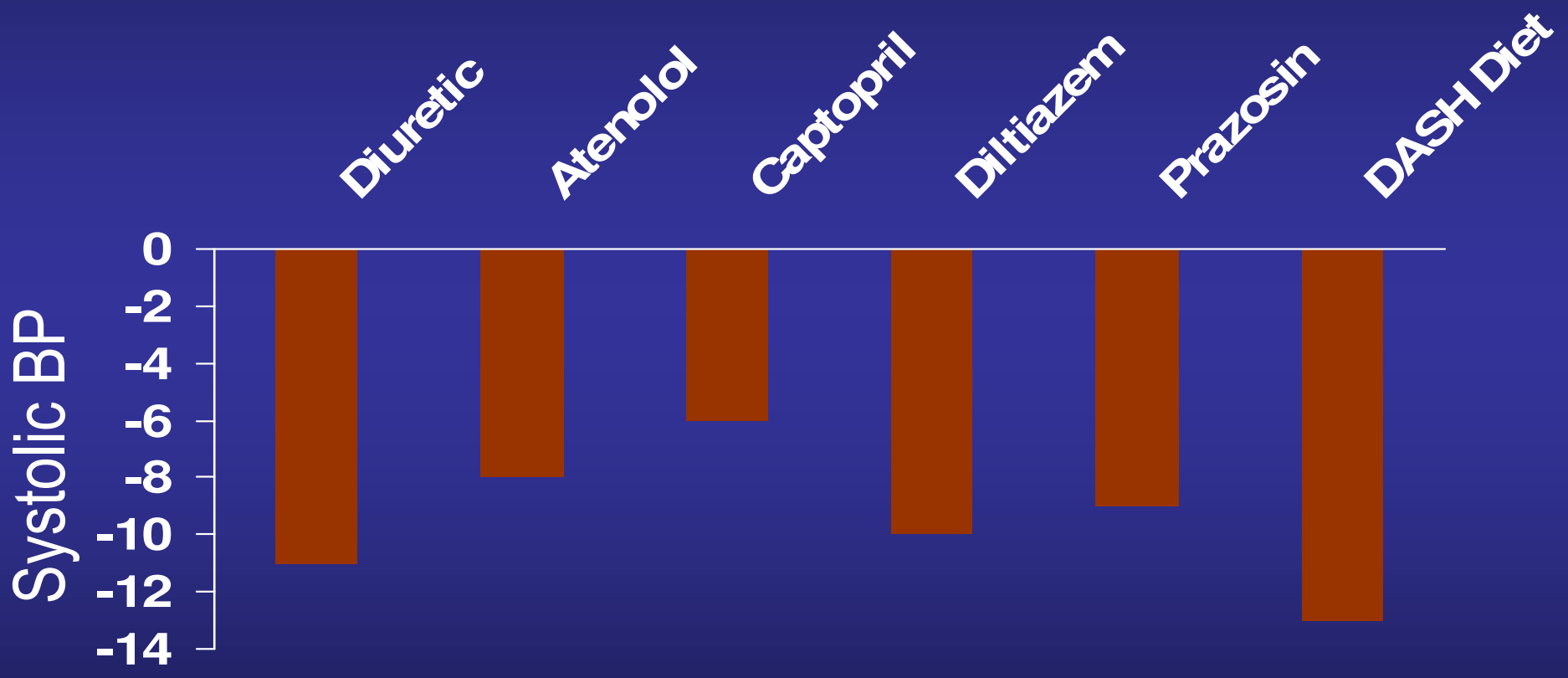
DASH/Lower Na vs Control/Higher Na: -15

DASH + Sodium Effects on SBP *By* Hypertension, Age, Race, Sex

		Hypertensive		Non-Hypertensive	
		<45yr	>45yr	<45yr	>45yr
Non-Afr-Am	*Men*	*-5.8*	*-11.4*	*-2.2*	*-7.9*
	Women	*-8.6*	*-14.3*	*-5.1*	*-10.8*
Afr.Am.	*Men*	*-6.6*	*-12.2*	*-3.0*	*-8.7*
	Women	*-9.4*	*-15.1*	*-5.9*	*-11.6*

Vollmer et al. Ann Intern Med 2001;135:1019

The DASH Low Sodium Diet Compared to Drug Therapy: Systolic Blood Pressure



VA Cooperative Study. N Engl J Med 1993;328:914

DASH and DASH-Sodium "Eating Right"

- To achieve DASH diet, emphasize fruits, vegetables, low-fat dairy, grains, variety of foods, overall low fat.
- To achieve lower sodium intake, patients and public should choose foods lower in sodium, and food industry should lower salt content.

Optimal Macronutrient Intake Trial to Prevent Heart Disease

Appel LJ, Sacks FM, Carey VJ, Obarzenek E, Swain J, Miller ER, Conlin P, Erlinger T, Rosner B, Laranjo N, Charleston J, McCarron P, Bishop L.

JAMA 2005;294:2455.

Background

- The DASH diet is rich in carbohydrate and reduced in saturated fat
  - lowers blood pressure and LDL cholesterol but
  - lowers HDL cholesterol and has no effect on triglycerides
- Replacing carbohydrate with protein or monounsaturated fat might lower blood pressure further and improve lipids, especially HDL and TG.

Appel LJ, Sacks FM, Carey VJ et al. JAMA 2005;294:2455.

Macronutrient Goals, % kcal

	CARB*	PROT	UNSAT
Carbohydrate	58	48	48
Protein	15	25	15
Fat	27	27	37
Monounsaturated	13	13	21
Polyunsaturated	8	8	10
Saturated	6	6	6

***Similar to DASH diet, except that the carbohydrate content of DASH was 55% kcal and its protein content 18% kcal.**

Sources of Protein (average daily intake)

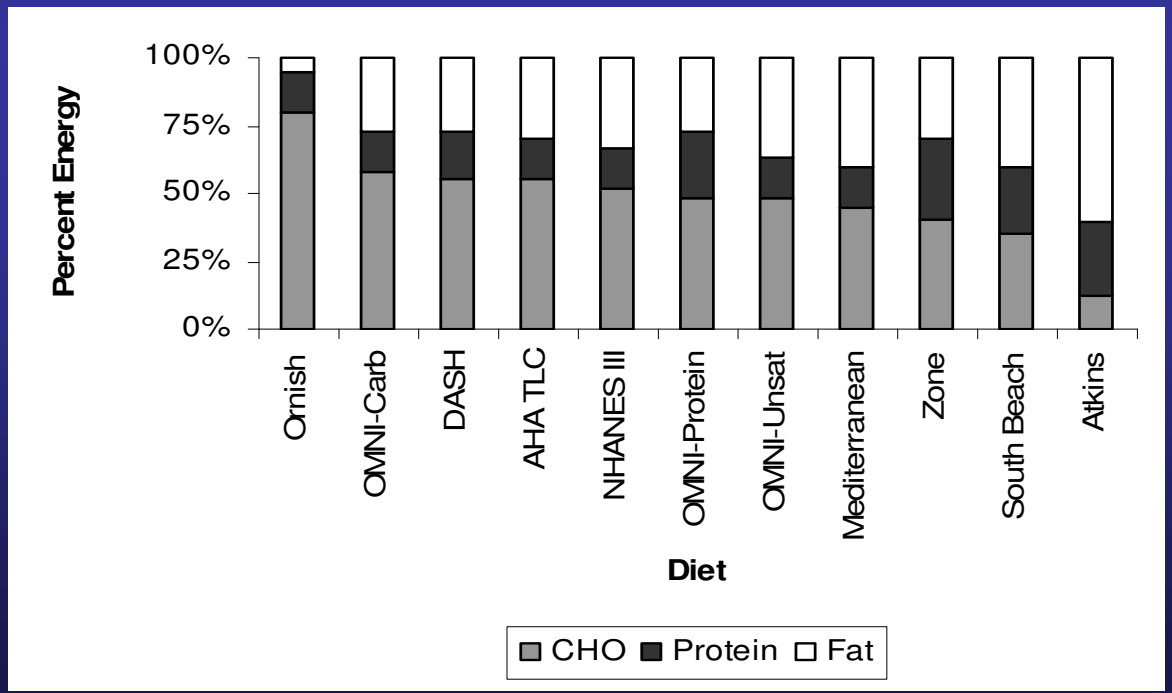
		DIET TYPE		
	Unit	CARB	PROT	UNSAT
Legumes, nuts, seeds, veg protein	Oz (g)	1.3 (36)	3 (84)	1.2 (34)
Milk, milk products	Oz (g)	2.1 (59)	2.5 (70)	1.9 (53)
Beef, pork, ham	Oz (g)	0.9 (25)	1.1 (31)	1 (28)
Poultry	Oz (g)	1.6 (45)	2.6 (73)	1.8 (50)
Fish	Oz (g)	1.1 (31)	1.3 (36)	1 (28)
Egg product substitutes	Oz (g)	0.2 (6)	1.1 (31)	0.1 (3)

Appel LJ, Sacks FM, Carey VJ et al. JAMA 2005;294:2455.

Comparison of DASH and Omni Diets with Popular Diets and US Intake

High Carbohydrate
Low Fat
Moderate Protein

Low Carbohydrate
High Fat
High Protein



Desousa R et al. AJCN 2008

DIET	DASH	OMNI-Carb	OMNI-Protein	OMNI-Unsat
Breakfast	bran flakes cereal medium banana low-fat milk whole wheat bread: soft (tub) margarine orange juice	Grapefruit juice Multi-bran cereal Skim milk Banana	Tomato juice Scrambled egg substitute with low-fat shredded cheese Hot cereal: bulgur wheat with soy, olive oil, margarine, raisins, and sugar Skim milk	Orange juice Cereal with raisins, skim milk White bread with olive oil margarine and jelly
Lunch	chicken salad whole wheat bread Dijon mustard salad: fresh cucumber slices tomato wedges sunflower seeds Italian dressing, low calorie fruit cocktail juice pack	Chicken sandwich: whole wheat bread, chicken breast, mayonnaise Salad: lettuce with olive oil Trail mix: almonds, dried apricots	Vegetarian burger: hamburger roll, vegetarian patty, barbecue sauce, lettuce with tomato slices Broccoli salad Unsalted potato chips Chocolate pudding	Chicken sandwich: white bread, chicken breast, barbecue sauce, olive oil margarine Olive oil potato chips Spinach salad with tomato and olive oil balsamic dressing Broccoli salad with safflower oil Tomato juice
Dinner	beef, eye of the round: beef gravy, fat-free green beans sautéed with: canola oil small baked potato: sour cream, fat-free grated cheddar cheese, reduced fat chopped scallions whole wheat roll: soft (tub) margarine small apple low-fat milk	Penne bean pasta with spinach, tomato, and olive oil, beef meatballs, parmesan cheese Tossed salad: romaine lettuce, cherry tomatoes, Italian dressing with safflower oil Fresh grapes Peppermint patty	Black bean taco: black beans and wheat protein with vegetables, 3-grain salad with olive oil Tortilla chips Chicken breast Fresh orange Skim milk	Black bean taco: black beans with vegetables, 3-grain pilaf with olive oil Tortilla chips Carrots, cooked Pecan cookie Skim milk
Snacks	1/3 cup almonds, unsalted 1/4 cup raisins 1/2 cup fruit yogurt, fat-free, no sugar added ¾ cup walnuts	Small fresh apple Yogurt	Fat-free cottage cheese Mandarin oranges Almonds	Mandarin oranges Almonds

Blood Pressure Results (mmHg)

		Mean Change from Baseline in Each Diet		
Systolic BP	Baseline	CARB	PROT	UNSAT
All	131	-8	-9	-9
HTN Only	**146**	**-13**	**-16**	**-16**
PreHTN Only	128	-7	-8	-8
Diastolic BP	77	-4	-5	-5

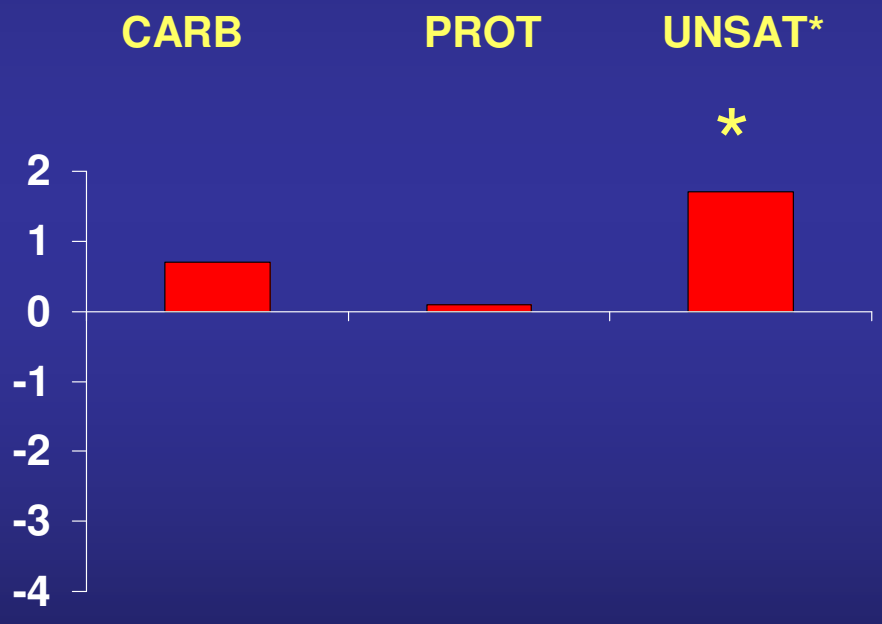
Lipid Results (mg/dL)

		Mean Change from Baseline in Each Diet		
LDL-C	Baseline	CARB	PROT	UNSAT
All	129	-12	-14	-13
LDL-C ≥ 130	**157**	**-20**	**-24**	**-22**
LDL-C < 130	105	-4	-6	-5
HDL-C	50	-1.4	-2.6	0
Triglycerides	102	0	-16	-9

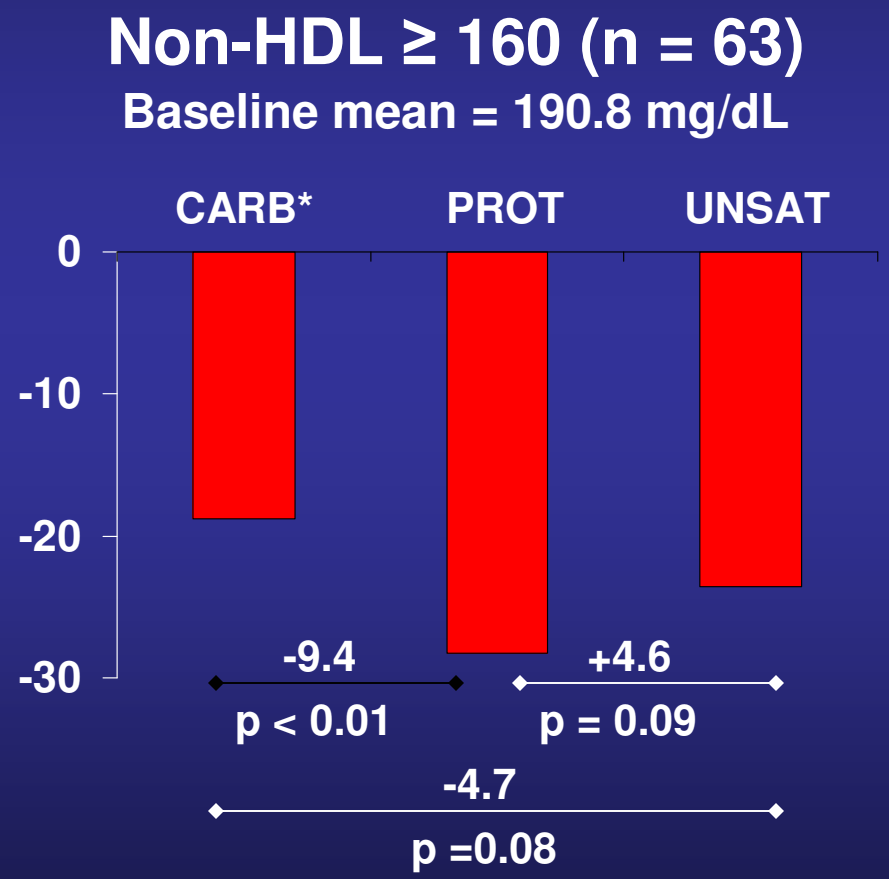
Low HDL Cholesterol: Benefit of Unsaturated Fat

HDL < 40M, <50F (n = 58)

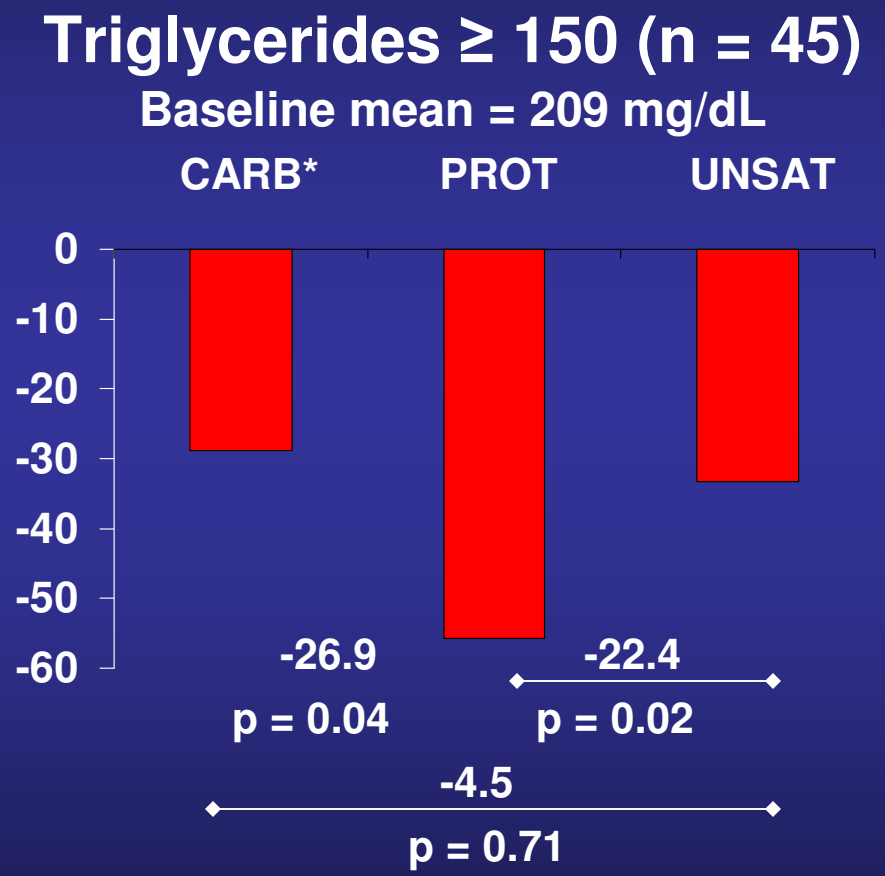
Baseline mean = 37.2 mg/dL



High Non - HDL Cholesterol: Enhanced Reduction with Protein or Unsat



High Triglycerides: Enhanced Reduction with Protein



Conclusions

- All three diets were healthy and had beneficial effects on CVD risk factors and CHD risk
- Currently recommended diets, typically rich in carbohydrate, can be improved by shifting some calories to protein or monounsaturated fat

Appel LJ, Sacks FM, Carey VJ et al. JAMA 2005;294:2455.

Diet Quality Improves Health in Overweight People *Even if they don't lose weight!!*

- DASH and OmniHeart studies improved diet quality and kept body weight constant.
- 50% of the research participants were obese; 25% overweight

Olive Oil, Mediterranean Diet, and Blood Pressure

- **Mediterranean diet: Reduction in BP**
  - Strazullo P et al. J Hypertens 1986;4:407
  - Esposito K..Giugliano G. JAMA Sept 22/29, 2004
- **Olive Oil**
  - Reduction in BP and reduced BP meds
    - Ferrara L et al. Arch Intern Med 2000;160
- **Olive oil and Mediterranean diet: Greek EPIC Study**
  - Both associated with decreased BP
    - Psaltopoulou T…Trichopolou A. Am J Clin Nutr October 4, 2004.
  - Cereal intake associated with higher BP
- **High Monounsaturated Fat vs High Carb in NIDDM**
  - Reduced BP: Rasmussen OW et al. Diabetes Care 1993;16:1565

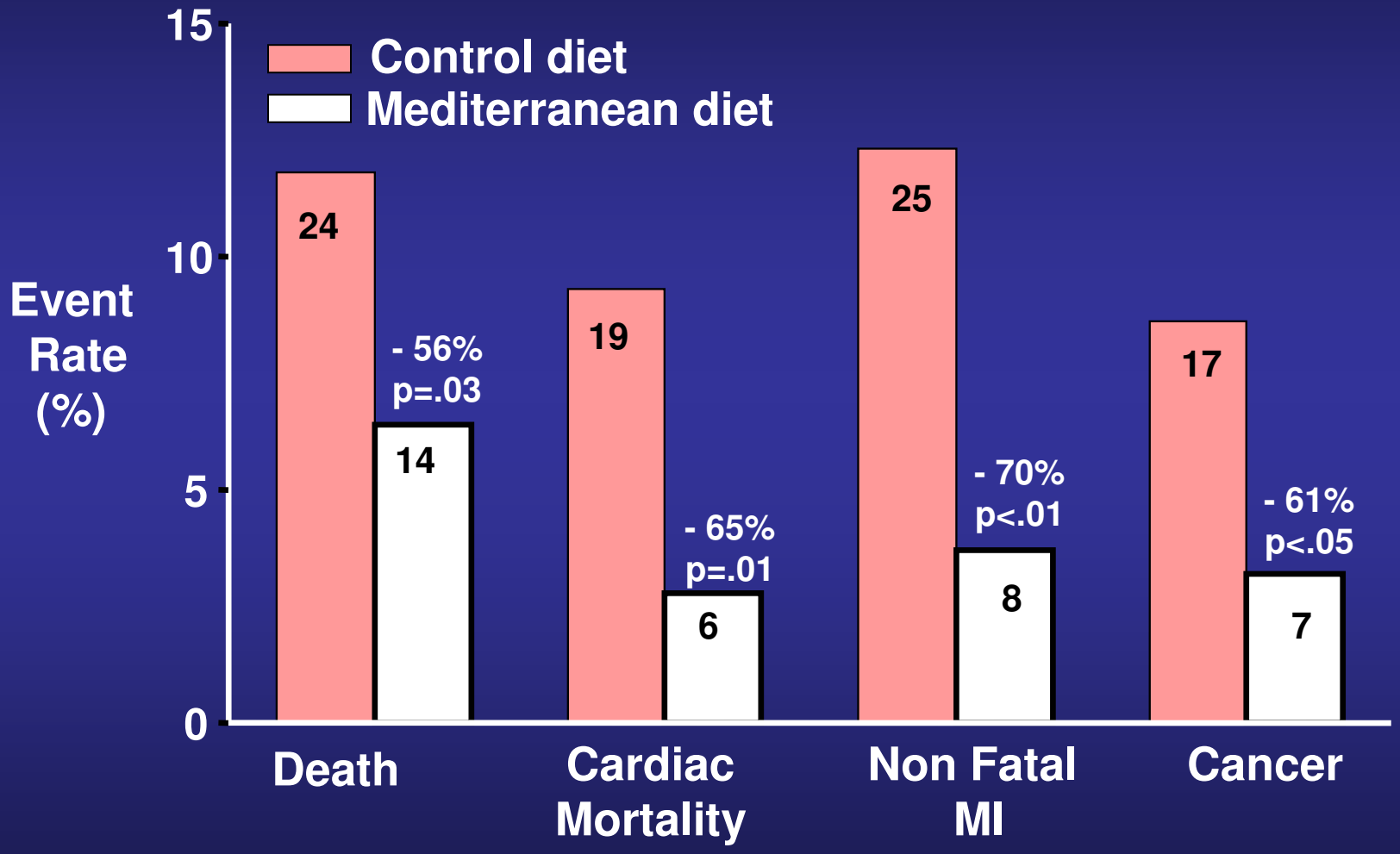
Mediterranean diet after myocardial infarction:

Changes in foods, nutrients, risk factors

Increased		*Decreased*	*Unchanged*
Fruits	Vegetable oil	Meats	Total fat (31-33%)
Vegetables	Oleic	Butter, cream	Cholesterol
Bread	Alpha linolenic	Saturated	Trans fatty acids
Beans	EPA, DHA	Linoleic	Blood cholesterol
Fiber	Vitamins C, E		Blood pressure
Cheese, Poultry, Fish			Body weight
			Platelet aggregation

De Lorgeril M et al. Lancet 1994:343:1454.

Lyon Heart Study



De Lorgeril. Arch Intern Med 1998;158:1161; Circulation 1999;99.

United States Study NIH-AARP, 1995-2005

214,284 men 166,012 women

Adherence to a Mediterranean style diet

- **Vegetables**
- **Legumes**
- **Fruits and nuts**
- **Whole grain**
- **MONO/SAT**
- **Fish**
- **Energy**
- **Red meat/dairy**

All cause mortality - 21%

CVD mortality -22%

Cancer mortality -17%

Panagiota N et al Arch Intern Med 2007

Mediterranean diet and CVD mortality

Ethnically diverse population in Melbourne, Australia
40,653 volunteers 1990-1994

Adherence to a Mediterranean style diet that included:

- Garlic
- Cucumber
- Olive oil
- Salad greens
- Capsicum
- Cooked dried legumes
- Legume soups
- Tomato
- Pasta dishes
- Olives
- Celery, Fennel
- Feta, ricotta cheese
- Fish
- Onion/leeks
- Chicken
- Leafy greens

Harriss LR et al. AJCN 2007

Consumption of Mediterranean foods:

↓ **-34% Total mortality**

↓ **-49% Ischemic heart disease**

Among those without previous history of CVD

Harriss LR et al. AJCN 2007

Intervention study in Spain: PREDIMED

Compared to low-fat diet:	Mediterranean Olive oil	Mediterranean Mixed nuts
↓ Plasma glucose levels (mmol/L)	-0.39	-0.30
↓ Systolic blood pressure (mmHg)	-5.9	-7.1
↓ Total to HDL cholesterol ratio	-0.38	-0.26

Estruch R et al Arch Intern Med, 2006

Protection from Obesity in Spain: Adherence to Traditional Mediterranean Diet

- Spanish men and women, 3100, average age 50, living in the northeast (Girona)
- Diet evaluated by interview.
- Mediterranean diet score computed using Trichopoulou's definition.
- Risk of obesity 39% less in those eating traditional diet.

Schroder H et al. J Nutr 2004;134:3355

Mediterranean Diet Protects Against Chronic Lung Disease in US Women

- Smoking is major cause of chronic obstructive lung disease, but not all smokers get it.
- 72,043 women, nurses
- 754 of them acquired chronic obstructive lung disease between 1984 and 2000.
- Good dietary pattern defined: fruits, vegetables, whole grains, fish
- 25% lower risk of chronic obstructive lung disease
- No relation to asthma

Varraso R et al. Am J Clin Nutr 2007;86:488

Rheumatoid Arthritis in Glasgow: Improvement with Mediterranean-type Diet

- Patients living in socially-deprived part of Glasgow, 130 women age 30-70.
- 75 randomized to Med-diet, 55 to control.
- Significant benefits at 3 and 6 months:
  - Improved global health assessment
  - Less pain
  - Less morning joint stiffness

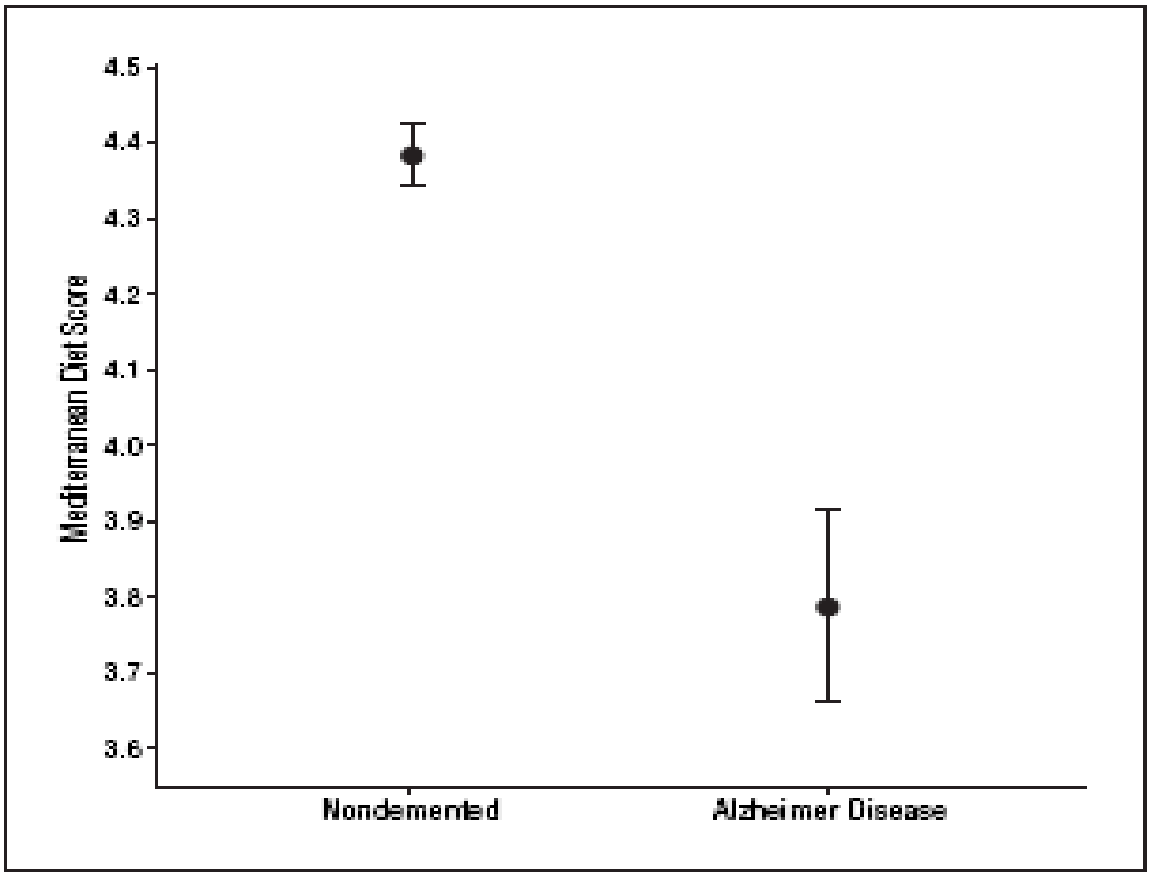
McKellar G et al. Ann Rheum Dis 2007;66:1239

Parkinson Disease: Protection by Mediterranean-type Dietary Pattern in US Population

- Population: 50,000 men and 81,000 women nurses and health professionals
- Parkinson disease cases during 16 years
- Dietary pattern defined by high intake of vegetables, legumes, fruit, nuts, whole grains, fish, and monounsaturated fats; moderate alcoholic drinking; small red meat intake (Trichopoulou definition)
- Med-type diet lowered risk by 25%.

Gao X…Ascherio A. Am J Clin Nutr 2007;86:1486

Alzheimer Disease: Reduced Risk with Mediterranean Diet in New York City



Scarmeas N et al. Arch Neurol 2006;63:1709

Summary: DASH, OmniHeart, Mediterranean-Type Diets: Higher Unsaturated Fats, Lower Carbohydrate, Higher Protein

- Large reduction in blood pressure
- Best diet composition to improve LDL/HDL ratio
- No induction of high TG
- Improved glycemic control in diabetics
- Long-term reduction in CVD (4 trials)
- Lower risk of many chronic diseases